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NOVEMBER, 1907

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Hepaticae of Puerto Rico

VIII. SYMBIEZIDIUM, MARCHESINIA, MASTIGOLEJEUNEA, CAUDALEJEUNEA, AND BRYOPTERIS

ALEXANDER WILLIAM EVANS

(WITH PLATES 31-33)

SYMBIEZIDIUM

The authors of the Synopsis Hepaticarum divided the genus *Lejeunea* into the three sections *Phragmicomoideae* (with 38 species), *Typicae* (with 225 species), and *Ceratanthae* (with 29 species).<sup>\*</sup> In these sections they included all the species which they referred to the genus, with the exception of a few which were incompletely known. Apparently the first attempt to segregate this vast group was made by Trevisan in 1877.<sup>†</sup> His method was very simple and consisted in the elevation of the three sections to generic rank. To the first he gave the name *Symbiezidium*, for the second he retained the name *Lejeunea*, for the third (as already noted by the writer in another connection) he revived the old generic name *Colura* of Dumortier. For some reason the genus *Symbiezidium* has been virtually ignored by subsequent writers, perhaps because Trevisan's compilation was so soon followed by the thorough and well-known work of Spruce on South American *Hepaticae*, perhaps because according to our present views the genus is still an aggregate and includes species which would now be distributed among ten recognized genera. Neither of these reasons is sufficient to

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<sup>\*</sup> *L. c.* 308-410. 1845; 748-770. 1847.

<sup>†</sup> Schema di una nuova classificazione delle epatiche. Mem. Ist. Lomb. III. 4: 383-451. 1877.

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invalidate its claims for recognition and, with emended characters, it should reappear in the literature of hepaticology. The first species which Trevisan quotes under *Symbiezidium* is *S. transversale*, based on the *Jungermannia transversalis* of Swartz. This species therefore should be regarded as the type of the genus. *J. transversalis*, however, has a number of close allies and forms with them the recognized genus *Platylejeunea*,\* one of the most natural genera of the *Lejeuneae*. In consequence of these facts the writer suggests that the name *Platylejeunea* be replaced by the older generic name of Trevisan.

As thus restricted the genus *Symbiezidium* comprises twelve species, nine of which grow in the American tropics and the other three on various islands of the Pacific. No species are known at present from either Asia or Africa. The genus includes some of the most robust of the *Lejeuneae*, the stems in certain species being sometimes 10–15 cm. in length. The plants tend to be glossy and are nearly always more or less pigmented with brown or olive. The stems are at first prostrate and sometimes the prostrate habit is retained throughout life by both stems and branches. In other cases the plants become pendulous, but a marked contrast between a creeping caudex and secondary, pendulous stems never becomes apparent. The branching is irregular and is often abundant on old plants. In nearly every case, however, the ends of the stem and of the principal branches remain simple for a considerable distance, thus giving the members of the genus a peculiar and characteristic appearance.

The leaves are more or less imbricated, and their lobes spread widely from the stem (PLATE 31, FIGURES 1, 11), not shrinking appreciably nor changing their position upon drying. They vary in outline from ovate-oblong to broadly ligulate and tend to be convex along the antical side and at the apex and concave along the postical side. They are rounded to subcordate at the base and arch across or a little beyond the axis (FIGURE 2). The apex is broad and almost always rounded but in certain species is occasionally apiculate or even subacute. Except for these rare apical teeth the margins are entire or nearly so.

The lobule, even in the same species, varies greatly in size and

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\* See Schiffner; Engler & Prantl. Nat. Pflanzenfam. 1<sup>3</sup>: 130. 1895.

in the degree of complexity which it exhibits. Much of this apparent variation, however, is simply due to imperfect development. In a normal lobule an inflated basal portion and plane outer portion may be clearly distinguished. The basal portion dilates abruptly from a short line of insertion and is strongly involute, the free margin thus coming into contact with the lobe. In this way a distinct water-sac is formed, which sometimes includes the greater part of the lobule. The sac often bulges forward considerably beyond the short basal line. The plane outer portion of the lobule beyond the sac is bounded by the sinus, which separates slightly from the lobe, thus opening up into the sac a passage-way along the keel. The sinus is usually straight or nearly so, but sometimes shows a rounded or blunt angle. If the involute portion of the free margin is spread out, a slight indentation will be found between its outer extremity and the beginning of the sinus. This indentation is bounded by two projecting cells between which a third cell is situated, sometimes at the bottom of the indentation, sometimes extending forward as far as the projecting cells themselves but in a different plane. The hyaline papilla is borne upon this third cell and is usually curved inward and concealed within the water-sac (FIGURES 6, 7). Apparently the cell which bears the papilla is homologous with the apex of the lobule as seen in other *Lejeuneae*. At any rate the lobule of a perigonal bract, which is normally acute and tipped with a single cell, bears a papilla upon this cell. The keel of the lobule varies greatly, being sometimes straight or slightly arched throughout, sometimes distinctly incurved near the base and arched in the outer portion.

The leaf-cells have firm and pigmented walls and often bulge slightly on the outer surface of the lobe. Their trigones (FIGURE 5) are usually distinct but vary greatly in size even on a single plant; they are of the triradiate type, and the ends of the rays are separated from one another and from the frequent intermediate thickenings by narrow pits. Ocelli are not developed. The cell-structure on the whole resembles that of *Lopholejeunea* and of several other genera of the *Lejeuneae*.

The underleaves in *Symbiesidium* are relatively large and are sometimes scarcely surpassed in size by the leaves themselves. They are attached by a strongly arched line of insertion and are

orbicular to reniform in outline (FIGURES 1, 3, 11). They are broad at the apex and vary at the base from cordate to cuneate and long-decurrent, a considerable degree of variation sometimes occurring in a single species. The rhizoids, which are occasionally very abundant, are borne on a rudimentary basal disc.

The female branch is exceedingly short, bearing a single rudimentary leaf with its underleaf in addition to the involucre and perianth (FIGURES 1, 11). All of these parts are so small that they are more or less completely hidden by the large foliage leaves. The flower innovates on one side, the innovation being short and simple. In autoicous species the innovation is sometimes occupied by a male spike. The perichaetial bracts are shortly and subequally bifid, the lobule in some cases being a little larger than the lobe, a remarkable and unique condition among the *Lejeuneae* (FIGURES 8, 9, 12, 13). Both lobe and lobule are entire and vary at the apex from rounded to apiculate. The bracteole is free and is sometimes truncate at the apex, sometimes retuse and sometimes distinctly bifid (FIGURES 10, 14).

The perianth bears a marked resemblance to that found in *Odontolejeunea*. It is obovate in outline and strongly compressed, the broad and low postical keel being rounded or bluntly two-angled in the upper part. The sharp lateral keels bear lacinate wings, and in certain species there are scattered laciniae on the postical surface. The apex of the perianth is distinctly beaked.

The male spikes vary in position and in length; they are sometimes found on leading branches, when they tend to proliferate (FIGURE 3), sometimes on short branches, the growth of which they tend to limit (FIGURE 4). The diandrous bracts are characterized by a rounded lobe and a more or less pointed lobule. The bracteoles are usually restricted to the base of the spike and become very rudimentary when they extend toward the apex. Rudimentary bracteoles are somewhat unusual among the *Lejeuneae* *Holostipae* but are also found in *Stictolejeunea* and in a few other genera.

The relationship between the present genus and *Lopholejeunea* is commented upon by Spruce. Both genera are characterized by fimbriate perianths, but in *Lopholejeunea* the plants are smaller and more deeply pigmented, the female inflorescence is borne on a

longer branch and is normally destitute of an innovation, the bracts are as large as the vegetative leaves or larger, and the male spikes bear bracteoles throughout their entire length. *Odontolejeunea* differs from *Symbiezidium* in its dentate leaves and underleaves, in its denticulate lobules, and in its longer female branch with large bracts.

Four species of *Symbiezidium* have been reported from Puerto Rico, two by Hampe and Gottsche from the collections of Schwanecke, and two others by Stephani from the collections of Sintenis. Of these four species only two occur in the material studied by the writer. These two species are described and figured in the present paper, and attention is called to the other two species.

SYMBIEZIDIUM TRANSVERSALE (Swartz) Trevis.

*Jungermannia transversalis* Swartz, Prodr. Fl. Ind. Occ. 144. 1788.

*Phragmicoma transversalis* Nees, Naturg. Europ. Leberm. 3: 248. 1838.

*Lejeunea transversalis* Nees; G. L. & N. Syn. Hep. 310. 1845 (excluding  $\beta$  and  $\gamma$ ).

*Symbiezidium transversale* Trevis. Mem. Ist. Lomb. III. 4: 403. 1877.

*Lejeunea* (*Platy-Lejeunea*) *transversalis* Spruce, Hep. Amaz. et And. 124. 1884.

*Platylejeunea transversalis* Schiffn.; Engler & Prantl, Nat. Pflanzenfam. 1<sup>3</sup>: 131. 1895.

Brownish- or yellowish-green, rarely bright-green, slightly glossy, at first scattered but afterwards forming depressed mats of considerable extent: stems prostrate, loosely adherent to the substratum, 0.25 mm. in diameter, at first simple or sparingly branched, becoming copiously and irregularly pinnate with age, the branches prostrate, similar to the stem but with somewhat smaller leaves, not microphyllous: leaves imbricated, the lobe widely spreading, falcate, ovate, on robust stems from 1.5–2 mm. long, 1.2 mm. wide, rounded to slightly cordate at the base and arching across or a little beyond the axis, antical margin slightly outwardly curved to the broad and rounded apex, postical margin incurved near keel and forming with it a rounded or obtuse angle; lobule ovate or ovate-lanceolate in general outline, 0.45 mm. long, 0.2 mm. wide, strongly inflated in the basal half; cells of lobe averaging 25  $\mu$  at

the margin,  $30\mu$  in the middle and  $40 \times 30\mu$  at the base, trigones with acute to truncate rays, intermediate thickenings circular: underleaves imbricated, plane or convex along the lateral margins (from below), plane or revolute at the apex, reniform, 1.2 mm. long, 2 mm. wide, straight to rounded or subcordate at the base and sometimes a little decurrent, apex broad, rounded to slightly retuse, margin entire or vaguely and irregularly sinuate: inflorescence dioicous: ♀ branch arising from the stem or a leading branch; bracts erect-spreading to widely spreading, complicate, sometimes with a short and narrow wing along the keel, lobe oblong, 0.85 mm. long, 0.35 mm. wide, rounded at the apex, lobule similar to the lobe, rounded to apiculate at the apex; bracteole oblong-obovate, 0.85 mm. long, 0.4 mm. wide, truncate to slightly bidentate at the apex with a lunulate sinus and blunt to apiculate teeth; perianth about half-exserted beyond the bracts but almost hidden by the foliage leaves, 1.25 mm. long, 1 mm. wide, truncate to subretuse at the apex with a short beak, lateral keels winged to about the middle, the wings deeply and irregularly lacinate to within from one to three cells of the keel, laciniae long and slender, mostly five to ten cells in length and one or two cells wide at the base, surface of perianth smooth or nearly so: ♂ inflorescence occupying a short branch or borne on a longer branch, in the latter case often proliferous; bracts mostly in five to ten pairs, imbricated, subequally bifid, the lobule obtuse, acute or apiculate, keel narrowly alate in the upper part, the wing one cell wide and crenulate; bracteoles at base of spike similar to the underleaves, wanting altogether or very rudimentary in the upper part: mature sporophyte not seen (PLATE 3 I, FIGURES 1-10).

On trees. Sierra de Naguabo, *Sintenis* (2). North slope of the Luquillo Mountains, *Heller* (784, 1144, 1159, 1161, 4761). El Yunque, *Evans* (25, 67, 126). The species is apparently confined to the West Indies. In addition to Puerto Rico, it is now known from the following islands: Jamaica, the type locality, *Swartz*, *Evans*; Cuba, *Underwood & Earle*; St. Kitts, *Brutel*; Dominica, *Eggers*, *Lloyd*. The specimens collected by *Sintenis*, which the writer has had the privilege of studying, evidently belong to the same species as the other specimens listed above. As *Stephani* states, the *Sintenis* material agrees closely with *Swartzian* specimens in the *Lindenberg* herbarium at Vienna, so that there can be no doubt about the correctness of the determination.

*S. transversale* is one of the most variable of the *Lejeuneae*, a

fact which Stephani has already emphasized.\* It varies not only in color and in size but also in some of the structural characters derived from the leaves, underleaves and floral organs, characters which are usually regarded as more or less constant. To a certain extent this variability is indicated in the preceding description, but the lobules and underleaves deserve a few words in addition. The lobules vary considerably in size, being sometimes no longer than the diameter of the axis; they vary more strikingly, however, in the relative size of the water-sac as compared with the plane portion. In extreme cases almost the whole of the lobule enters into the formation of the sac, and under these circumstances the keel sometimes makes a very acute angle with the stem, thus giving the lobule a strong superficial resemblance to the water-sacs in *Frullania*. The underleaves vary somewhat in outline but are nearly always broader than long. They show more marked variation at the base. The margin in this region is sometimes straight, meeting the axis at approximately a right-angle, but it may be rounded, subcordate or distinctly short-decurrent. It is not unusual to find these various conditions on the underleaves of a single stem, and even the two sides of the same underleaf are sometimes very different from each other. The perianth yields some of the most constant characters of the species, although its outline varies somewhat with age, becoming longer as the sporophyte develops. In rare cases the postal surface bears a few scattered cilia near the apex, but it is usually smooth.

SYMBIEZIDIUM GRANULATUM (Nees) Trevis.

*Jungermannia granulata* Nees; Martius, Fl. Bras. **1**: 352. 1833.

*Phragmicoma granulata* Nees, Naturg. Europ. Leberm. **3**: 248. 1838.

*Lejeunea granulata* Nees; G. L. & N. Syn. Hep. 311. 1845.

*Symbiezium granulatum* Trevis. Mem. Ist. Lomb. III. **4**: 403. 1877.

*Lejeunea* (*Platy-Lejeunea*) *taeniopsis* Spruce, Hep. Amaz. et And. **126**. 1884.

*Lejeunia* (*Platylejeunea*) *granulata* Steph. Hedwigia **27**: 285. 1888.

*Platylejeunea granulata* Evans, Trans. Conn. Acad. **10**: 417. 1902.

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\* Hedwigia **27**: 286. 1888.



Puerto Rico, without definite locality, *Schwanecke*. The original determination of these specimens by Hampe and Gottsche has been confirmed by Stephani and also by Schiffner. The species has also been recorded from Brazil, the type locality, *Sellow, Spruce*; from Surinam, *Reichenbach, Kegel*; and from St. Vincent, *Elliott*. Stephani also mentions specimens from Ecuador without giving the collector's name.

*S. granulatum* is known to the writer mainly from South American specimens, and these are too incomplete to give an adequate idea of the species. Its relationship to *S. transversale* is very close, but Stephani considers the two species distinct. In pointing out the differences between them he notes that the lobule in *S. granulatum* is smaller and also that the underleaves are smaller, more rotund in outline, cuneate and long-decurrent at the base and reflexed on the margin. The underleaves in *S. transversale* are said to be reniform, rounded at the base and plane. From the notes on *S. transversale* already given in the present paper it will be seen that some of these differential characters are not altogether reliable, on account of the great variability of the species. It should be stated, however, that the underleaves of *S. granulatum* seem to be constantly cuneate at the base, and that their decurrence is not only more constant but more pronounced than in *S. transversale*. Whether the differential characters which Stephani derives from the perianth are trustworthy is also open to some doubt. In *S. granulatum* the wings of the perianth are said to be coarsely dentate, while those of *S. transversale* are described as long-fimbriate. According to Spruce, however, the wings in *L. taeniopsis*, which Stephani reduces without question to *S. granulatum*, are incised-ciliate, some of the cilia being very long. Apparently some of these questions cannot be settled until more complete material is available for study.

***Symbiezidium barbiflorum* (Lindenb. & Gottsche)**

*Lejeunea transversalis*  $\beta$  *Hookeriana* G. L. & N. Syn. Hep. 311. 1845.  
*Jungermannia incrassata* Tayl. *l. c.* (as synonym).

*Lejeunea barbiflora* Lindenb. & Gottsche, *Linnaea* 24: 630. 1851.

*Lejeunea* (*Platylejeunea*) *barbiflora* Steph. Hedwigia 27: 282. 1888.

*Lejeunea* (*Platylejeunea*) *incrassata* Tayl.; Bescherelle & Spruce,  
Bull. Soc. Bot. France 36: clxxix. 1889.

Brownish-green, growing in depressed mats, similar in general habit to *S. transversale*: stems 0.15 mm. in diameter: leaves imbricated, the lobe plane or slightly convex along the antical side and sometimes revolute at the apex, scarcely falcate, ovate-oblong, mostly 1–1.2 mm. long and 0.7–0.85 mm. wide, rounded or subcordate at the base and arching across or just beyond the axis, antical margin slightly outwardly curved to the broad and rounded apex, postical margin nearly straight; lobule very variable and often poorly developed, in normal cases attaining a maximum size of  $0.35 \times 0.25$  mm. but often only half as large, similar in structure to that of *S. transversale*; cells of lobe averaging  $17\mu$  at the margin,  $28\mu$  in the middle, and  $35\mu$  at the base, local thickenings of the walls often inconspicuous: underleaves imbricated, plane or a little concave (from below) and sometimes slightly reflexed at the apex, orbicular, 0.75 mm. long, abruptly cuneate and long-decurrent at the base: inflorescence autoicous: subfloral innovation sterile or occupied by a male spike; perichaetial bracts similar to those of *S. transversale* but smaller, both lobe and lobule measuring 0.5–0.7 mm. in length and 0.25–0.35 mm. in width, usually rounded at the apex; bracteole ovate-rectangular, 0.5 mm. long, 0.35 mm. wide, bifid one fourth to one third with a variable sinus and rounded to acute or apiculate divisions; perianth about two thirds exerted beyond the bracts and usually extending beyond the leaves, 1 mm. long, 0.85 mm. wide, truncate at the apex and with a short beak, lateral keels winged in the upper part, the wings deeply and irregularly incised to within one or two cells of the keel, the alar teeth mostly from three to six cells long and one or two cells wide at the base, sometimes subdivided, postical surface with a low keel, rounded or sometimes two-angled in the upper part, surface-laciniae numerous, similar to the alar teeth, irregularly scattered or sometimes more crowded along the angles of the postical keel: ♂ inflorescence occupying a short branch or a subfloral innovation, rarely terminal on a longer branch, not proliferating; bracts mostly in from three to six pairs, imbricated, similar to those of *S. transversale*; bracteoles mostly restricted to the base of the spike: mature sporophyte not seen (PLATE 31, FIGURES 11–14).

On rotten logs. Puerto Rico, without definite locality, *Schwanecke*. North slope of the Luquillo Mountains, *Heller* (779). The species has also been collected in Surinam, the type locality, *Kegel*, *Parker*, and on the islands of Cuba, *Underwood & Earle*, and Guadeloupe, *Marie*. Through the kindness of correspondents the writer has been able to compare Heller's specimens with a portion of Kegel's type material, with Schwanecke's Puerto Rico specimens,

and also with Marie's type specimens of *Lejeunea incrassata*. All of these various plants agree closely with one another and evidently belong to the same species.

*S. barbiflorum* is a smaller plant than *S. transversale*, the lobes of its leaves are less falcate and plane or nearly so along the postical side, and its underleaves are constantly long-decurrent. It is further distinguished by its autoicous inflorescence and by the scattered laciniae on the postical surface of the perianth. In rare cases these laciniae are few in number or even absent altogether, and a smooth or nearly smooth perianth is the result. These smooth perianths, however, present every appearance of being poorly developed, and since they are usually found on plants which bear normal perianths as well, they will rarely be a source of confusion. In all the involucre examined the bracteole has been distinctly bifid, and it is possible that this character may also be relied upon in distinguishing the species from its allies.

SYMBIEZIDIUM VINCENTINUM (Gottsche) Trevis.

*Lejeunea vincentina* Gottsche; G. L. & N. Syn. Hep. 313. 1845.

*Symbiezidium vincentinum* Trevis. Mem. Ist. Lomb. III. 4: 403. 1877.

*Lejeunea (Platy-Lejeunea) vincentina* Spruce, Hep. Amaz. et And. 127. 1885.

*Platylejeunea vincentina* Schiffn.; Engler & Prantl, Nat. Pflanzenfam. 1<sup>3</sup>: 131. 1895.

Puerto Rico, without definite locality, *Sintenis* (64). The type locality of the species is the island of St. Vincent, but the original collector is not mentioned by Gottsche. The following stations have also been recorded: Guadeloupe, *Husnot*; Dominica, *Elliott*; Colombia, *Moritz*; Brazil, *Schenck*; Ecuador, *Spruce*. The species has also been collected in Jamaica by *Maxon*, but no specimens from Puerto Rico have been seen by the writer.

*S. vincentinum* agrees with *S. barbiflorum* in its autoicous inflorescence. Its leaves, however, although usually rounded at the apex, are occasionally apiculate or shortly acute, a peculiarity which is emphasized by both Gottsche and Spruce. The underleaves are somewhat broader than in *S. barbiflorum*, tending to be reniform in outline, but they agree in being decurrent. The

perianth, finally, is provided with incised wings along the lateral keels but is usually quite free from surface-laciniae. In a single instance a very few cilia were found at the apex of the indistinct postical keel. In comparing *S. vincentinum* with *S. transversale* it is seen to be a somewhat smaller plant and to differ in its autoicous inflorescence, in its occasionally apiculate leaves, and in its constantly decurrent underleaves. In other respects the two species are much alike. The material of *S. vincentinum* at the writer's disposal, although including a portion of the type specimen from the Hooker herbarium, is too incomplete to give a good idea of its various forms, and more study will be necessary before its differential characters are fully understood.

### MARCHESINIA

The genus *Marchesinia* of S. F. Gray (1821)\* was monotypic, being based on the single species *Jungermannia Mackaii* Hook. The genus *Phragmicoma* of Dumortier,† published the following year, was also monotypic and was based on the same species. *Phragmicoma* should therefore be considered a simple synonym of *Marchesinia*. Dumortier's genus, however, was accepted by Nees von Esenbeck,‡ who referred to it sixteen tropical species in addition to the single species upon which it was based. In the Synopsis Hepaticarum § the genus is still further enlarged by the addition of other tropical species until it numbers thirty-four in all. With the exception of three species these are all included in the two sections *Typus* (with six species) and *Ptychanthoides* (with twenty-five). *Phragmicoma* continued to be used by writers until Gray's genus was revived by Carruthers|| in the original sense. When Trevisan¶ made use of the genus *Marchesinia* he gave it practically the characters of *Phragmicoma*, section *Typus*, of the Synopsis, referring to it seven species in all. The section *Ptychanthoides* became his new genus *Ptychocoleus*. Spruce recognized neither *Marchesinia* nor *Phragmicoma* as a genus, but his subgenus

\* Nat. Arr. Brit. Pl. 1: 689. 1821 (as *Marchesinus* and *Marchesinius*).

† Comm. Bot. 112. 1822.

‡ Naturg. Europ. Leberm. 3: 245. 1838.

§ L. c., 292, 740. 1845 and 1847.

|| Jour. Bot. 3: 301. 1865.

¶ Mem. Ist. Lomb. III. 4: 405. 1877.

*Homalo-Lejeunea* \* is proposed as their practical equivalent. When Schiffner † raised *Homalo-Lejeunea* to generic rank he appreciated this fact and designated the genus by the name *Marchesinia*. It is worthy of note that Spruce's subgeneric name has never been applied to a formally published genus, although species of *Homalolejeunea* may be found described in the literature.

The species of *Marchesinia*, like those of the preceding genus, are among the most robust of the *Lejeuneae*. At the present time about fourteen species are recognized; of these the type species, *M. Mackaii* (Hook.) S. F. Gray, has a local distribution in Europe, two are known from Africa, a few others from the Galapagos and Hawaiian Islands, and the remainder from tropical America. They grow occasionally on rocks but more frequently on the bark of trees or on rotten logs, and certain species are found on both inorganic and organic substrata. The plants sometimes grow mixed with other bryophytes but usually form pure mats of considerable extent. They are more or less pigmented with brown or purple and in some of the species are distinctly glossy.

The stems are at first prostrate and often look very much as if they might belong to the genus *Symbiesidium*. In most species, however, secondary stems are soon developed, which separate more or less completely from the substratum. These stems give the plants a more characteristic appearance, and in old tufts it becomes difficult to find traces of the original prostrate stems. The secondary stems are irregularly pinnate and sometimes grow for a considerable distance without branching. In most of the species the female stems exhibit a striking false dichotomy, owing to the development of subfloral innovations in pairs.

The leaves are more or less imbricated and, so far as their lobes are concerned, bear much resemblance to those of the preceding genus. In certain species, however, the apical region is constantly or occasionally dentate (PLATE 32, FIGURES 1, 2, 17). The lobules exhibit considerable variety in form and in size but possess certain structural features in common. In normal cases, for example, the free margin bears a distinct apical tooth; this may be blunt, consist-

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\* Hep. Amaz. et And. 132. 1884.

† Engler & Prantl, Nat. Pflanzenfam. 1<sup>3</sup>: 128. 1895.

ing of a single projecting cell, or it may be longer and prolonged into a straight or curved row of from two to four cells. Frequently the tooth is bent inward toward the lobe. The hyaline papilla is situated in the vicinity of this tooth but is displaced several cells from the margin on the inner surface of the lobule (FIGURE 6). In addition to the apical tooth the free margin sometimes bears from one to three accessory teeth between the apex and the base (FIGURES 3, 16), but these vary considerably in size and degree of distinctness even when normally present and in some species are apparently absent altogether. The leaf-cells are essentially like those of *Symbiesidium* (FIGURE 4), but the local thickenings of the walls are sometimes very indistinct. The underleaves are also very much alike in the two genera.

The female inflorescence in *Marchesinia* is borne on a leading branch and normally innovates on both sides (FIGURE 1), the innovations varying greatly in length and often being limited in growth by the development of new inflorescences. In a few of the species, however, of which *M. Mackaii* is a striking example, double innovations are the exception rather than the rule, most of the flowers innovating on only one side. The lobes of the bracts are similar to those of the foliage leaves but tend to be narrower and more strongly dentate (FIGURES 7, 8, 11, 12, etc.). The lobules are distinct but vary greatly in form, size, and marginal characters, a considerable degree of variation being sometimes observable on an individual plant (FIGURES 14, 15). The bracteoles are free and mostly oblong to obovate in outline; they are frequently toothed (FIGURES 9, 13, 20) and sometimes distinctly bifid (FIGURE 21).

The perianth is one of the most characteristic features of the genus. It is strongly compressed and broadly oblong or obovate in outline (FIGURE 1). The apex is truncate or slightly retuse with rounded outer angles and bears a distinct beak. The postical keel is low and scarcely discernible, and there are no teeth either on the sharp lateral keels or on the postical surface. In many respects the perianth resembles that found in *Stictolijunea*, but there are never distinct auricles at the upper angles.

The male inflorescence is usually terminal on a more or less elongated branch and bears bracteoles throughout its entire length. The bracts are imbricated and bear the antheridia singly or in

pairs. In some cases the two lobes are subequal; in other cases the lobe is distinctly larger than the lobule. In the paroicous *M. robusta* (Mitt.) Schiffn., Spruce notes that antheridia are occasionally developed in the axils of the perichaetial bracts.

At the present time the only species of *Marchesinia* known from Puerto Rico is the variable and widely distributed *M. brachiata*, and even this species has not been previously recorded from the island. It may be described as follows:

MARCHESINIA BRACHIATA (Swartz) Schiffn.

- Jungermannia brachiata* Swartz, Prodr. Fl. Ind. Occ. 144. 1788.  
*Lejeunea Bongardiana* Lehm. & Lindenb.; Lehmann, Pug. Plant. 7: 18. 1838.  
*Phragmicoma Guilleminiana* Nees & Mont. Ann. Sci. Nat. Bot. II. 16: 128. 1841.  
*Lejeunea brachiata* Nees; G. L. & N. Syn. Hep. 313. 1845.  
*Lejeunea complicata* Hampe, l. c. 321. 1845.  
*Phragmicoma Bongardiana* Lindenb. l. c. 740. 1847.  
*Symbiesidium brachiatum* Trevis. Mem. Ist. Lomb. III. 4: 403. 1877.  
*Marchesinia Guilleminiana* Trevis. l. c. 405. 1877.  
*Marchesinia Bongardiana* Trevis. l. c. 405. 1877.  
*Lejeunea (Homalo-Lejeunea) Guilleminiana* Spruce, Hep. Amaz. et And. 134. 1884.  
*Lejeunea (Homalo-Lejeunea) Bongardiana* Spruce, l. c. 135. 1884.  
*Lejeunea (Homalo-Lejeunea) brachiata* Steph. Hedwigia 29: 14. 1890.  
*Marchesinia brachiata* Schiffn.; Engler & Prantl, Nat. Pflanzenfam. 1<sup>3</sup>: 128. 1895.

Olive- or purplish-green, glossy, scattered or growing in loose tufts: secondary stems 0.35 mm. in diameter, at first pendent but eventually spreading at the tips, sparingly pinnate or, on female plants, falsely dichotomous, the branches similar to the stem, not microphyllous but sometimes with smaller leaves: leaves loosely imbricated, the lobe widely spreading, scarcely falcate, ovate, 2 mm. long, 1.2 mm. wide, slightly convex especially along the postical margin and sometimes revolute at the apex, rounded or subcordate at the base and arching across or a little beyond the axis, antical margin slightly outwardly curved to apex, postical

margin straight or nearly so, forming an angle of  $90^\circ$  or more with the keel, apex abruptly acute or apiculate, margin otherwise entire or sparingly and irregularly denticulate in the outer part; lobule ovate, trapezoidal in outline, more or less inflated, especially in basal and carinal regions, keel arched, free margin dilated and sometimes involute near base, straight or a little curved in outer part, apical tooth usually consisting of two superimposed teeth, accessory teeth normally two, each consisting of a single projecting cell, often indistinct or obsolete, sinus straight or nearly so, forming an angle of  $135-180^\circ$  with postical margin of lobe; cells of lobe plane or a little convex, averaging  $22\mu$  at the margin,  $40 \times 30\mu$  in the middle and  $55 \times 45\mu$  at the base, trigones distinct and usually conspicuous, triradiate, the rays either acute or dilated and rounded at the apex, intermediate thickenings numerous, circular or oval, pits usually distinct and often relatively broad: underleaves imbricated, broadly orbicular, 1-1.7 mm. long, rounded and narrowly revolute at the apex, gradually or abruptly cuneate toward the base, long-decurrent and attached by a strongly arched line, the decurrent portion sometimes minutely rounded at the very base, margin entire or minutely denticulate in apical region: inflorescence dioicous: ♀ inflorescence terminating a secondary stem or a leading branch, innovating on both sides, the innovations obliquely spreading, simple or soon again floriferous; bracts obliquely spreading, the lobe ovate-oblong, 2.2 mm. long, 1.1 mm. wide, apex abruptly apiculate or acute, margin entire or sharply and irregularly dentate in the upper half, the teeth sometimes numbering as many as twelve; lobule (maximum size) 1 mm. long, 0.65 mm. wide (often much smaller), ovate to lanceolate, mostly acute and sometimes entire but usually irregularly dentate or lacerate; bracteole free, obovate, 1.5 mm. long, 1.25 mm. wide, cuneate toward base, apex broad, rounded, retuse or shortly bifid, margin sharply and irregularly dentate in the upper part; perianth more than half exserted, obovate-oblong in outline, 4 mm. long, 2 mm. wide, apex truncate or slightly retuse, basal region cuneate: ♂ inflorescence and mature sporophyte not seen (PLATE 32).

On trees, rotten logs, and rocks. North slope of the Luquillo Mountains, *Heller* (1145). El Yunque, *Evans* (59). Mount Morales, near Utuado, *Howe* (1088, 1127, 1136). The species is very abundant in the mountains of Jamaica, the type locality, where it was originally collected by *Swartz* and more recently by *Underwood* and by the writer. The following localities may also be noted:—Mexico, *Liebmann*; Cuba, *Wright*, *Underwood*, *Mrs.*



*Britton*; St. Vincent and Dominica, *Elliott*; Trinidad, *Fendler*; Venezuela, *Moritz*, *Funck & Schlim*; Colombia, *Moritz*; Brazil, *Guillemin* (the type specimen of *P. Guilleminiana*), *Chamisso* (the type specimen of *L. Bongardiana*), *Beyrich*, *Hantsch*, *Lindman*; Ecuador, *Spruce*; Bolivia, *Rusby*; Galapagos Islands, *Baur*.

The synonymy as given above is based largely on the work of Stephani. When he studied the *Lejeuneae* in the Lindenberg herbarium\* he found that Montagne's specimen of *P. Guilleminiana* was identical with another Brazilian specimen which had been referred to *L. brachiata* and which he considered authentic. He therefore reduced Montagne's species to synonymy. Stephani's decision was soon confirmed by Schiffner,† who was able to study a portion of Swartz's original Jamaican material in the herbarium at Berlin. Both authors agreed further that *L. Bongardiana* was simply a very lax form of *M. brachiata* from wet situations. Spruce, to be sure, considered *L. Guilleminiana* as distinct from *L. Bongardiana*, but it is by no means certain that the Peruvian specimens which he referred to Montagne's species were correctly determined. These specimens were distributed in *Hepaticae Spruceanae*, and, since they do not agree in all respects with West Indian material of *M. brachiata*, perhaps represent a distinct species. Judging from the specimens of *P. Bongardiana* distributed by Wright in his *Hepaticae Cubenses*, this species might almost be considered valid. Schiffner states, however, that even these specimens, which represent an extreme form, are connected with typical *M. brachiata* by a series of intermediate conditions.

Accepting *M. brachiata* in the broad sense of Stephani and Schiffner, it is certainly a most variable species. Its numerous forms show marked differences in size, in color, and in certain structural characters derived from leaves, underleaves, and floral organs. The lobes of the leaves, for example, may be entire or dentate. The lobules may be strongly dilated and involute at the base so that they project forward beyond the line of attachment, they may be but slightly dilated with the free margin extending obliquely from the axis, or they may remain in a poorly developed condition. The leaf-cells normally show conspicuous trigones,

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\* Hedwigia 29: 6. 1890.

† Bot. Jahrb. 23: 581. 1897.

but in certain delicate forms the local thickenings are scarcely to be demonstrated. The underleaves are usually reflexed at the apex, but they are occasionally plane, and their margins vary from entire to denticulate. The bracts and bracteoles vary greatly with respect to their marginal teeth, and the lobules of the bracts vary not only in size but but also in form. Among the most constant characters of the species are the following: the apiculate or acute leaves, the tridenticulate lobules, the decurrent and usually reflexed underleaves, the more or less toothed bracts, and the toothed and bifid bracteole. Unfortunately even these characters are subject to some variation, but will usually serve to distinguish the species from its allies. The perianth is also a remarkably constant organ but presents no reliable differential characters.

In the preceding description the inflorescence of *M. brachiata* is described as dioicous, because the specimens studied by the writer have all been either sterile or purely archegonial. Spruce also admits that the inflorescence in *L. Bongardiana* is dioicous but implies that it is normally autoicous in his somewhat doubtful *L. Guilleminiana*. Gottsche\* also ascribes a monoicous inflorescence to the same species. It would perhaps be more accurate, therefore, to describe the inflorescence as polyoicous. Gottsche gives but few details about the antheridial spike. He says that it is either terminal on a branch or intercalary, that the bracts are in eight to ten pairs, and that the antheridia are borne singly or in pairs.

### MASTIGOLEJEUNEA

The genus *Mastigolejeunea* is very widely distributed in tropical and subtropical regions and contains from thirty to thirty-five recognized species. The majority of these grow on trees or on logs, but a few are sometimes found on rocks. The genus is apparently confined to low altitudes, from the sea level up to two thousand feet. The first species mentioned by Spruce and by Schiffner is *M. auriculata* (Wils. & Hook.) Schiffn. This may therefore be considered the type of the genus. At the present time it is the only species known to occur in Puerto Rico. In fact no other species have been recorded from North America, if we

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\* Mex. Leverm. 171. 1863.

except the African *Mastigo-Lejeunea crispula* Steph.,\* which its author reports from Costa Rica.† The plants belonging to this genus usually form depressed mats of considerable extent. They are often deeply pigmented and sometimes appear almost black, with little or no lustre, when they become dry. The pigmentation, however, rarely shows the brownish hues which are characteristic of such genera as *Lopholejeunea* and *Symbiesidium*, and the plants are occasionally glaucous.

The distinction between creeping caudex and secondary stems is much better marked in *Mastigo-Lejeunea* than in the two preceding genera. The caudex clings closely to the substratum by means of numerous rhizoids and in an old tuft is difficult to demonstrate except along the edges. The secondary stems, although frequently prostrate, develop very few rhizoids and can be easily separated from the substratum. These stems branch irregularly and sometimes copiously and branches of a second or higher order often occur. The branches are of three types: normal branches similar to the stem, microphyllous branches with shorter and relatively broader leaves, flagelliform branches with very rudimentary leaves. These distinctions, however, are not always well-marked, and it frequently happens that a branch is microphyllous at the base and normal or flagelliform at the extremity. The flagelliform branches usually develop an abundance of rhizoids and doubtless play an important part in affixing the plants to the substratum.

The leaves are densely crowded; when dry they spread obliquely and are strongly convex, overlapping each other closely; when moist they become squarrose and spread more widely, the imbrication being thereby much less apparent. The lobes are falcate from a round or subcordate base and vary in outline from ligulate to ovate. The postical margin is more or less revolute, thus increasing the appearance of convexity, but the antical margin is plane or nearly so. The apex varies from rounded to subacute and is never reflexed. The margin is entire or vaguely and irregularly sinuate but is never distinctly dentate.

The lobule usually consists of two portions, a narrow inflated water-sac along the keel, and a plane portion along the free

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\* Hedwigia 27: 111. 1883.

† Bull. Soc. Roy. Bot. Belgique 31: 180. 1892.

margin. The water sac opens out into the revolute portion of the lobe, and it is often difficult to distinguish where the sinus ends and the postical margin of the lobe begins. The plane portion varies greatly in form and in size but is normally appressed to the lobe. Frequently, however, no plane portion is developed, the free margin being revolute and the whole lobule entering into the formation of the water-sac. The free margin is so variable, even in a single species, that it is difficult to assign it definite characters. It is sometimes entire or nearly so, passing by an indistinct rounded angle, which represents the apex, into the vaguely defined sinus. In other cases the apex is much more distinct, being tipped by a single cell or even by a cell-row consisting of several cells. When the apical tooth is well developed there is sometimes a second tooth at some little distance from it on the proximal side. The hyaline papilla is also proximal in position but is sometimes marginal and sometimes slightly displaced from the margin and hidden within the water-sac. Many of these variations are clearly shown by *M. auriculata*.

The leaf-cells are usually longer than broad and are plane or nearly so. They are characterized by distinct trigones, but the intermediate thickenings are infrequent except toward the base of the lobe. Sometimes the trigones are confluent but rarely sufficiently so to obliterate the pits. The cell-wall is the seat of the pigmentation, and the middle lamella by its still deeper color is sometimes but not always distinguishable. No ocelli are developed.

The underleaves vary from distant to closely imbricated. They are attached by an almost straight line and broaden out from a cuneate base. In outline they vary from orbicular to obovate, the apex being broad and frequently retuse. On robust stems they are convex in the middle (from below) and their margins, which are entire or nearly so, are more or less revolute along the sides or at the apex.

The primary female inflorescence is borne on a secondary stem or one of its leading branches and innovates on one side or more rarely on both. The innovations are sometimes long and similar to the stem, but they are more frequently abbreviated and repeatedly floriferous. The complicate bracts are deeply and unequally

bifid; the lobes are broader than in the leaves and tend to be more pointed, the lobules are rounded to retuse at the apex, and the keels are destitute of wings. The bracteole is free and larger than the underleaves but otherwise similar to them.

The perianth is more or less concealed by the bracts and is oblong in outline varying to pyriform or obovate. It is strongly trigonous with sharp lateral keels and a high and narrow postical keel. In certain species supplementary keels, both antical and postical, are developed, but the trigonous character of the perianth still remains apparent. The principal keels are sometimes provided with narrow and interrupted wings, which are destitute of teeth. The beak of the perianth is short but distinct.

The male inflorescence is terminal on a leading branch but often proliferates at the apex. The bracts are numerous and crowded, bearing the antheridia singly, and the bracteoles extend along the whole length of the spike.

The genera *Mastigolejeunea* and *Thysananthus* are so closely allied that the propriety of trying to keep them separate is perhaps questionable. In *Mastigolejeunea* the lobes of the leaves, the underleaves, the bracts, bracteoles and keels of the perianth are entire; in *Thysananthus* they are more or less dentate. In other respects the two genera are essentially alike. The subgenera *Dendro-Lejeunea* Spruce\* and *Phragmo-Lejeunea* Schiffn., † separated from *Thysananthus* on account of their lack of flagelliform branches, are now included by Schiffner ‡ under *Thysananthus* and have never been recognized as genera.

*M. auriculata* has recently been described by the writer, with figures and a full synonymy, in another connection. § In the present paper, therefore, attention is simply called to its general distribution and to its local distribution in Puerto Rico.

#### MASTIGOLEJEUNEA AURICULATA (Wils. & Hook.) Schiffn.

On trees, rotten logs and rocks. Near Mayaguez, *Heller* (4462, 4463), *Mrs. Britton & Miss Marble* (649 p. p.). Road from Arecibo to Utuado, *Howe* (378). The species is widely dis-

\* Hep. Amaz. et And. 110. 1884.

† Lebermoose der Forschungsreise S. M. S. Gazelle 24. 1890.

‡ Engler & Prantl, Nat. Pflanzenfam. 1<sup>3</sup>: 129. 1895.

§ Mem. Torrey Club 8: 129. pl. 17. f. 10-19. 1902.

tributed in tropical and subtropical America, and the following localities may also be noted : Florida, Alabama, and Louisiana in the United States ; Mexico, *Liebmann* ; Bahama Islands, *Coker, Mrs. Britton* ; Cuba, *Wright, Underwood & Earle, Mrs. Britton* ; Hayti, *Nash* ; Jamaica, *Mrs. Britton, Evans* ; Colombia, *Moritz* ; Surinam, *Kegel* ; Brazil, *Spruce, Lindman* ; Paraguay, *Lindman* ; Peru, *Spruce*.

### CAUDALEJEUNEA

In the subgenus *Lopho-Lejeunea* as originally proposed Spruce included a Brazilian species which he called *L. harpaphylla*, remarking at the same time that it differed from the other members of the subgenus in several important respects. A few years later Stephani\* proposed the subgenus *Cauda-Lejeunea* for the reception of *L. harpaphylla* and its allies. Meanwhile Spruce had also reached the conclusion that his species ought to be separated subgenerically from *Lopholejeunea* and suggested, in a paper by Pearson,† that it be made the type of a new subgenus, to which he gave the name *Callistolejeunea*. Since Stephani's name was more formally published and clearly had the right of priority, it was used by Schiffner as the proper name of the group when he raised it to generic rank.

Schiffner accredits eight species to the genus and enumerates seven of them by name. The omitted species is *L. (Cauda-Lejeunea) Lehmanniana*, which ought really to be considered the type species because it is the first one mentioned by Stephani. Of the listed species three are from tropical America, two from Africa, one from various islands of the Pacific, and one from tropical Asia. *L. Lehmanniana* is also from tropical America. Stephani has since added two species to the genus, one from Cuba and Brazil and the other from New Guinea, so that it now apparently contains ten species in all. The species from Asia, however, has never been published except as a *nomen nudum*, and in the opinion of the writer the five so-called American species are simply forms of a single one. If this opinion is accepted, there will be only five well-established species left in the genus. The American species,

\* Hedwigia 29 : 18. 1890.

† Christiania Vidensk.-Selsk. Forhandl. 1892 : 7.

which has been collected once in Puerto Rico, may be described as follows:

**Caudalejeunea Lehmanniana** (Gottsche)

*Lejeunea Lehmanniana* Gottsche; G. L. & N. Syn. Hep. 325. 1845.

*Lejeunea Crescentiae* Lindenb. & Gottsche, *l. c.* 752. 1847.

*Lejeunea (Lopho-Lejeunea) harpaphylla* Spruce, Hep. Amaz. et And. 123. 1884.

*Phragmicoma Haenkeana* Schiffn. Bot. Centralbl. 27: *pl. 1. f. 3.* 1886.

*Lejeunea (Mastigolejeunea) Haenkeana* Steph. Hedwigia 28: 257. 1889.

*Lejeunea (Cauda-Lejeunea) Lehmanniana* Steph. *l. c.* 29: 18. 1890.

*Lejeunea (Cauda-Lejeunea) Leiboldii* Steph. *l. c.* 19. 1890 (*nomen nudum*).

*Lejeunea (Cauda-Lejeunea) harpaphylla* Steph. *l. c.* 19. 1890.

*Lejeunea (Cauda-Lejeunea) Crescentiae* Steph. *l. c.* 19. 1890.

*Caudalejeunea harpaphylla* Schiffn.; Engler & Prantl, Nat. Pflanzenfam. 1<sup>3</sup>: 129. 1895.

*Caudalejeunea Crescentiae* Schiffn. *l. c.* 129. 1895.

*Caudalejeunea Haenkeana* Schiffn. *l. c.* 129. 1895.

*Caudalejeunea Leiboldii* Steph. Hedwigia 34: 233. 1895.

Bright- or pale-green, not glossy, scattered or growing in loose tufts: stems prostrate, 0.15 mm. in diameter, irregularly pinnate, the branches obliquely spreading, simple or sparingly subdivided, similar to the stem but often ascending and free from the substratum: leaves loosely imbricated, the lobe plane or somewhat convex, obliquely to widely spreading, more or less falcate, oblong-ovate, 1–1.3 mm. long, 0.6–0.7 mm. wide, arching across or a little beyond the axis, rounded at the base, antical margin outwardly curved to the apex, postical margin straight or a little curved, forming a continuous line or a very obtuse angle with the slightly arched keel, apex varying from rounded to acute, margin usually entire, sometimes irregularly angular-dentate near the apex; lobule inflated throughout, ovate-oblong in outline, 0.35 mm. long, 0.17 mm. wide, free margin usually revolute and appressed to the lobe throughout a part of its length, crenulate near base, mostly bidentate in outer part, the apical tooth being acute and curved, often three or four cells long and two or three

cells wide at the base, the inner (proximal) tooth shorter, blunter and frequently obsolete, sinus long and shallow, forming an acute angle with the keel, hyaline papilla marginal, situated near the proximal base of the apical tooth, often reflexed and hidden within the water-sac; cells of lobe averaging  $14\mu$  at the margin,  $28 \times 21\mu$  in the middle, and  $35 \times 28\mu$  at the base, slightly convex, thin-walled but with distinct local thickenings, the trigones circular or vaguely triangular in outline, the intermediate thickenings numerous, circular, sometimes two or even three between two trigones; ocelli none: underleaves distant to subimbricated, orbicular, plane or nearly so, 0.35 mm. long, cuneate toward the base and distinctly short-decurrent on both sides, line of attachment somewhat arched, apex broad and more or less retuse, margin entire or nearly so: inflorescence autoicous: ♀ inflorescence sometimes borne on the main stem or on a leading branch but usually on a more or less abbreviated branch, without innovation; one or several pairs of leaves below the involucre intermediate in character between the bracts and normal leaves; bracts obliquely spreading, the lobe ovate-lanceolate, 1–1.4 mm. long, 0.45–0.6 mm. wide, subacute to acuminate, antical margin distinctly outwardly curved, postical margin less curved or nearly straight, margin entire or irregularly dentate in the upper part; lobule consisting of a narrow, more or less inflated fold at the base of the lobe, measuring about  $0.5 \times 0.09$  mm., margin passing very gradually into the postical margin of the lobe without a distinct apex, entire; bracteole free, plane or nearly so, ovate, 0.75–0.85 mm. long, 0.4–0.5 mm. wide, gradually narrowed toward the apex, bifid about one tenth with erect, acute and often connivent teeth separated by a narrow sinus, margin entire or irregularly sinuate to dentate in the upper part; perianth less than half exerted, obovate in outline from a narrow base, measuring  $1 \times 0.75$  mm. when well grown, apex broad, truncate to retuse with a distinct beak variable in length, trigonous, with sharp lateral keels and a high and narrow postical keel extending from the apex to the middle or below, antical surface plane or nearly so, lateral keels sometimes narrowly and interruptedly alate, the wing entire or sparingly and irregularly sinuate or dentate: ♂ inflorescence terminal, often on a leading branch; bracts mostly in from three to six pairs, imbricated, diandrous, shortly and unequally bifid with obtuse to acute divisions, the lobe ovate-oblong or ovate-ligulate, the lobule ovate, keel arched; bracteoles imbricated, extending along the whole length of the spike, orbicular to ovate, retuse to bidentate at the apex with rounded to acute divisions: mature sporophyte not seen (PLATE 33, FIGURES 1–12).



On twigs. Santurce, *Heller* (838). The species also grows on living leaves, and has been recorded from the following additional localities: Mexico, *Liebmann* (the type specimen of *L. Crescentiae*), *Haenke* (the type specimen of *P. Haenkeana*); Costa Rica, *Tondus*; Cuba, *Wright*, *Leibold* (the type specimen of *C. Leiboldii*), *Underwood*, *Mrs. Britton*; Brazil, *Liebmann* (the type specimen of *L. Lehmanniana*), *Spruce* (the type specimen of *L. harpaphylla*), *Ule*.

Largely through the kindness of correspondents the writer has been enabled to examine type material of *L. Lehmanniana* and *L. Crescentiae* and authentic material of *L. harpaphylla* and *C. Leiboldii*. *P. Haenkeana* is still known to him from *Schiffner's* description and figures only, but these are sufficient to indicate that the species is synonymous with the others, and *Schiffner* himself admits that it may not be distinct from *C. Crescentiae*.<sup>\*</sup> *Stephani* has already reduced *L. harpaphylla* to a synonym of the same species.<sup>†</sup>

If the original descriptions of *L. Lehmanniana*, *L. Crescentiae* and *C. Leiboldii* are consulted it will be seen that the three are very much alike, the most important differences between them being derived from the involucre leaves and the perianths. In the first the bracts (and also the upper leaves) are said to be apiculate, sparingly serrate, or serrulate-denticulate at the apex, the bracteole is said to be serrate, and the perianth sparingly ciliate on the margin. In the second and third the bracts, bracteoles and perianths are said to be entire.

The type material of *L. Lehmanniana* is very scanty. The portion from the Lindenberg herbarium studied by the writer consists of two fragments, one with a perianth and two male inflorescences, the other with two perianths. The perichaetial bracts are irregularly dentate, the teeth varying with respect to both number and size (FIGURE 1). The bract which is most strongly dentate shows seven teeth, the longest three cells long and two cells wide at the base, the shortest consisting of a single slightly projecting cell. Other bracts show only one or two teeth, thus exhibiting an approach to an entire condition. The lateral keels

<sup>\*</sup>Bot. Jahrb. 23: 585 (footnote). 1897.

<sup>†</sup>Hedwigia 34: 234. 1895.

of the perianth are irregularly dentate, but the postical keel, which is rather indistinct, is destitute of teeth. On the whole the denotation of both bracts and perianths is so indefinite that it can hardly be considered a valid specific character, more especially since similar teeth are occasionally found in *L. Crescentiae*. In *C. Leiboldii* the bracts and perianths are usually entire but often show indications of marginal teeth. The forms of *C. Lehmanniana*, which grow on living leaves and which have heretofore been referred to *L. Crescentiae*, show a marked development of the prostrate portions of the plant and thus acquire a somewhat peculiar appearance. This, however, is not supported by any structural characters which would justify us in attempting to separate these leaf-forms specifically, and Stephani did not hesitate to refer to *L. Crescentiae*, as a synonym, the *L. harpaphylla* of Spruce, which grew on bark. According to Schiffner *P. Haenkeana* is found on both leaves and bark.

The writer has as yet been unable to compare *C. Lehmanniana* with other members of the genus and therefore makes no attempt to discuss the generic characters in detail. Perhaps the genus is best characterized by its trigonous perianth and lack of subfloral innovations. The latter character and the fact that the lateral keels of the perianth are sometimes toothed indicates a relationship to the genus *Lopholejeunea*, but in this genus the plants are deeply pigmented, the lobule is differently constructed, and the postical keel of the perianth is sharply two-angled. The trigonous perianth in *Caudalejeunea* allies it with *Mastigolejeunea* and *Thysananthus*, but in both of these genera subfloral innovations are a constant feature. It is an interesting fact that one of the most important differential characters separating these genera breaks down in *Caudalejeunea*, both entire and toothed leaves being sometimes present on a single individual.

#### BRYOPTERIS

The genus *Bryopteris* is so distinct that it has had a rather uneventful history. Two of its best known species, *B. filicina* and *B. diffusa*, were originally collected by Swartz in the West Indies and were described by him under *Jungermannia* in 1788. About thirty years later *J. filicina* was figured and redescribed by

Hooker,\* who pointed out its possible affinity to the two European species, *J. dilatata* and *J. Tamarisci*. Raddi expressed this relationship more positively by referring *J. filicina* to his recently established genus *Frullania*, which he had based upon *J. dilatata* and *J. Tamarisci*. He also included in the same genus a plant which he described as new and figured under the name *F. dichotoma* but which is now considered identical with Swartz's *J. diffusa*.† The name *Bryopteris* first appears in the writings of Nees von Esenbeck, who applied it to a subgenus under *Frullania*.‡ In this subgenus he included three species, *F. filicina*, *F. diffusa*, and *F. spathulistipa*, the last being the earlier *Jungermannia spathulistipa* R. Bl. & N., of Java.§ When Lindenberg, in the Synopsis Hepaticarum, raised *Bryopteris* to generic rank, he excluded the third of these species, transferring it to the genus *Thysananthus*, which he proposed in the same volume.|| Under *Bryopteris* he included not only *B. filicina* and *B. diffusa* but also five other species, most of which were described as new. *B. filicina*, being the first species described, may be considered the type of the genus. Lindenberg apparently recognized the fact that *Bryopteris* was related to the *Lejeuneae* rather more closely than to *Frullania*, because he placed it at the beginning of the subtribe *Jubulcae*, *Frullania* being placed at the end and *Lejeunea*, with its immediate allies, occupying an intermediate position. Spruce emphasized the relationship to the *Lejeuneae* still more strongly by reducing *Bryopteris* to a subgenus under *Lejeunea*, giving it the name *Bryo-Lejeunea* to conform with his other subgeneric names.¶ Its generic rank, however, was soon restored to it by Schiffner, and it is now again known by its original name *Bryopteris*.\*\*

The genus is confined to the tropics, and at the present time about nine species are recognized. These seem to flourish equally well both on trees and on rocks and frequently grow in exposed localities. All of the species are American except *B. Gaudichaudii*

\* Musc. Exot. *pl.* 142. 1819.

† Mem. Soc. Ital. Modena Fis. 19: 35. 1823; 20: *pl.* 1a. 1829.

‡ Naturg. Europ. Leberm. 3: 211 (footnote). 1838.

§ Nova Acta Acad. Caes. Leop.-Carol. 12: 212. 1824.

|| *L. c.* 284. 1845; 737. 1847.

¶ Hep. Amaz. et. And. 111. 1884.

\*\* Engler & Prantl, Nat. Pflanzenfam. 13: 130. 1895.

Gottsche,\* which is known from Asia and from the Mascarene Islands. The only species which has been reported from Puerto Rico is the type of the genus, *B. filicina*, but it is probable that other species remain to be discovered. Unfortunately for the systematist certain members of the genus are exceedingly variable, and it often becomes difficult, on this account, to discover valid differential characters between closely related species.

The distinction between a prostrate caudex and secondary stems is even better marked in *Bryopteris* than in *Mastigolejeunea*. The caudex, which is sparingly and irregularly branched, is closely appressed to the substratum, clinging to it by means of numerous rhizoids. The secondary stems spread widely from the substratum and develop few or no rhizoids. They are slender, but more or less elongated, sometimes attaining a length of 30 cm. or more. The stems exhibit a pinnate branching and the branches are usually short and limited in growth. For these reasons and also because the branches develop in one plane, the secondary shoot-systems acquire a characteristic fern-like appearance, which accounts for the generic name. In some species the branches normally remain simple; in others they tend to be more or less subdivided. The branches usually bear smaller leaves than the main axis, but strongly resemble it in other respects. In *B. tenuicaulis* Tayl., however, and probably in other species, slender flagelliform branches are often produced upon which the leaves and underleaves are not only minute but exhibit modifications in form and structure.

An apparent exception to the pinnate form of branching is found in *B. diffusa*, which is described in the literature as dichotomous. Of course a true dichotomy is unknown among the *Jungermanniaceae*, and an examination of this species shows that the branching is really monopodial in character, just as in the other members of the genus. A branch, however, is as robust as the main axis and deflects it to one side, thus producing the effect of a fork. The branches are farther apart than in the other species and tend to be unlimited in growth and to become branched themselves in the same manner as the original axis. In this way the entire shoot-system seems to be made up of a series of dichotomies.

From a morphological standpoint the branches in *Bryopteris*

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\* Ann. Sci. Nat. Bot. IV. 8: pl. 16. f. 19-28. 1857.

agree essentially with those found in *Stictolejeunea*.<sup>\*</sup> In other words, each normal vegetative branch represents the postical half of one of the lateral segments cut off from the apical cell (PLATE 33, FIGURE 13), while each sexual branch, either male or female, represents a portion only of such a half-segment (FIGURE 16). When flagelliform branches are produced these agree with the sexual branches in origin, arising behind leaves with lobules.

The leaves present a very different appearance according to whether they are dry or wet. When dry they are suberect and strongly convex, tending to be closely imbricated and wrapped about the axis. When wet they spread widely from the axis and become more nearly plane, although the postical margin usually remains more or less revolute (FIGURES 13, 16). The lobes are falcate from a cordate base (FIGURE 14) and are approximately ovate in outline, being distinctly narrowed in the outer part. The apex is acute and the margin more or less serrate, the teeth being sometimes restricted to the apical region and sometimes extending well toward the base. These teeth vary greatly in size, but are usually sharp and coarse, resembling those found in *Thysananthus*.

The lobule is less definite in structure than in most genera of the *Lejeuneae* and sometimes consists of little more than a dilation at the postical base of the lobe. Even when well-developed it is attached to the axis by an exceedingly short line, from which it expands abruptly. The free margin is involute near the base and more nearly plane in the outer part, the sinus passing gradually into the postical margin of the lobe. In this way a rudimentary water-sac is formed at the base of the lobule with a broad opening leading into it. In some cases the sac opens directly into the revolute portion of the lobe. The hyaline papilla is unusually large but tends to disappear early on account of its fragile nature. It is situated on the free margin a short distance beyond the middle (FIGURE 20). In certain species there is neither indentation nor tooth to mark its position; in other cases there is a rounded angle which is proximal in position to the papilla. This angle evidently represents the apex of the lobule and marks the beginning of the sinus. The papilla may therefore be considered as distal to the apex.

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<sup>\*</sup> See Evans, Bull. Torrey Club 34: 4. 1907.

In *B. diffusa* the lobule exhibits characters which are decidedly aberrant. As in the other species the line of attachment is very short, the free margin is involute near the base and the sinus passes gradually into the postical margin of the lobe. The free margin, however, instead of being straight or rounded in the apical region, is coarsely and sharply dentate. In normal cases three teeth are developed, the median tooth being larger than the others and sometimes attaining a length of ten cells and a width of seven or eight cells at the base. In rare instances a small additional tooth, proximal in position to the others, may also be demonstrated. In the few cases where the hyaline papilla was observed it occupied a position on the inner surface of the most distal tooth, close to the sharp sinus between this tooth and the median tooth. The remarkable peculiarities just described, taken in connection with the false dichotomy of the species, are perhaps sufficient to warrant a generic separation of *B. diffusa* from *Bryopteris*. If it is still retained in the genus, the large median tooth must be considered the apex of the lobule, the tooth bearing the papilla would then be situated in what is morphologically the sinus, and the papilla itself, slightly displaced from the margin, would be distal to the apex.

The leaf-cells are plane or slightly convex and vary considerably in size and in form in different parts of the lobe. In the basal auricles they are isodiametric, but in other parts of the lobe they are nearly always distinctly longer than broad (FIGURE 17). The largest and most elongated cells occupy a broad band in the postical part of the lobe, extending from the base (FIGURE 18) to about the middle. These cells are often four times as long as broad but are never truly prosenchymatous. In the middle of the band they lie with their long axes approximately parallel, but they become more or less divergent as the vague boundaries of the band are approached. In passing from this band toward the margins and apex of the lobe, the cells gradually decrease in size and in relative length, some of the marginal cells being nearly isodiametric (FIGURE 19). The elongated cells thus form an indistinct false nerve, similar to those found in certain species of *Bazzania* and *Herberta*. The cell-walls are practically colorless and show well-developed local thickenings, which are

approximately circular in outline. In the most elongated cells there are frequently four or five intermediate thickenings between two trigones. In most of the species the thickenings show a strong tendency to become confluent and thus to obliterate the pits. Enough of the latter, however, usually persist to enable a cell to communicate with most if not all of the cells which surround it, but not infrequently lateral communication between cells is completely cut off. On account of the peculiarities of the wall the cavities of the cells acquire a wavy contour, not unlike what is found in the cells of *Herberta* and several other genera of the *Jungermanniaceae*.

The underleaves are usually contiguous or imbricated (FIGURE 16). They vary in outline from oblong or obovate to orbicular or quadrate and are attached by an arched line of insertion. The broad apex is rounded or truncate, and the base, which varies from rounded to cuneate, is usually abruptly decurrent. The apical region is toothed as in the leaves, the teeth sometimes extending down the sides as far as the middle. The lateral margins are more or less involute (from below), and the median basal region is distinctly gibbous, the bulge sometimes partially concealing the line of attachment.

The female branches are short and destitute of subfloral innovations (FIGURE 15). They usually arise in abundance from both stem and primary branches. Their leaves are reduced to four or five pairs, including the involucre, and there is a gradual transition from the minute basal leaves, closely appressed to the branch, and the large and widely spreading perichaetial bracts. All of the leaves are distinctly modified (FIGURE 21). The innermost bracts are deeply and unequally bifid, the lobule being narrower than the lobe but often fully as long. Both are long-acuminate and usually bear scattered teeth, especially near the apex. The bracteole is free and also bifid, with long-acuminate divisions separated by a narrow sinus. Both lobules and bracteole tend to be more or less revolute along the margin.

The perianth projects beyond the involucre for about half its length and is ovate or oblong in outline, bearing a distinct beak at the rounded or slightly retuse apex. It is strongly compressed with a high and narrow postical keel. The sharp lateral keels are

at first deflexed, making the perianth convex antically and concave postically, the postical keel running lengthwise through the concavity (FIGURE 22). As the sporophyte develops the perianth becomes more inflated, and the lateral keels tend to straighten out. The surface is perfectly smooth and the three keels are entirely destitute of both wings and teeth.

The male branches also arise from both stem and primary branches (FIGURE 16). The inflorescence usually occupies the entire branch but occasionally proliferates at the apex. The bracts, which vary considerably in number, are imbricated and shortly bifid with acute lobes. The antheridia are borne in pairs, and the bracteoles, which extend along the whole length of the spike, tend to be bidentate at the apex.

BRYOPTERIS FILICINA (Swartz) Nees

*Jungermannia filicina* Swartz, Prodr. Fl. Ind. Occ. 145. 1788.

*Frullania filicina* Raddi, Mem. Soc. Ital. Modena Fis. 19: 35. 1823.

*Frullania (Bryopteris) filicina* Nees, Naturg. Europ. Leberm. 3: 211 (footnote). 1838.

*Bryopteris filicina* Nees; G. L. N. Syn. Hep. 284. 1845.

*Lejeunea (Bryo-Lejeunea) filicina* Spruce, Hep. Amaz et And. 113. 1884.

Dark-green, growing in loose tufts: secondary stems 10–15 cm. long, 0.4 mm. in diameter, rather closely pinnate, the branches subopposite or distinctly alternate, spreading at an angle of about 60°, mostly 1.5–2.5 cm. long, rarely subdivided; flagelliform branches none: leaves imbricated (even when wet), falcate, ovate, about 2 mm. long and 1 mm. wide on the stem, a little smaller on the branches, arching a little beyond the axis, antical margin more or less outwardly curved from the cordate or auriculate base to the acute apex, postical margin slightly curved, revolute for half its length or more, marginal teeth usually confined to the apical region, from one to three on each side of the apex, mostly two or three cells long from a broad base, margin otherwise entire or vaguely sinuate; lobule inflated, ovate, 0.2 mm. long, 0.17 mm. wide, keel arched, water-sac opening directly into the revolute portion of the lobe, free margin straight or slightly rounded in the outer part, without a distinct apex; cells of lobe averaging  $7\mu$  at the margin,  $25 \times 11\mu$  in the middle, and  $52 \times 14\mu$  near the base, plane or nearly so, local thickenings large and more or less



confluent, the trigones mostly triangular in outline with two sides convex, and one concave: underleaves imbricated, obovate-quadrate, 0.8 mm. long, 0.7 mm. wide, rounded to truncate at the apex, cuneate and short-decurrent at the base, lateral margins more or less revolute and entire or nearly so, apex plane, coarsely and irregularly dentate, the teeth mostly six to ten, similar to those on the leaves: inflorescence autoicous: ♀ branches numerous, arising from both stem and primary branches; (innermost) bracts widely spreading, the lobe ovate, 2 mm. long, 0.7 mm. wide, long-acuminate, irregularly toothed in the upper part, lobule lanceolate, 1.5–2 mm. long, 0.35 mm. wide, long-acuminate and toothed in upper part, revolute along the free margin; bracteole narrowly ovate, 2 mm. long, 0.7 mm. wide, bifid about one fourth with long-acuminate divisions, sparingly denticulate in the upper part, more or less revolute along the lateral margins; perianth narrowly ovate in outline, 2–2.5 mm. long, 1 mm. wide: ♂ branches numerous, arising from both stem and primary branches; bracts in about six pairs, an entire spike about as long as one of the stem-leaves: capsule 1 mm. in diameter; spores greenish, irregular in form but usually longer than broad, measuring about  $25\ \mu$  in short diameter, minutely verruculose; elaters about 0.5 mm. long,  $12\ \mu$  in diameter (PLATE 33, FIGURES 13–22).

Puerto Rico, without definite locality, *Sintenis* (1), reported by Stephani. No specimens of *Bryopteris* occur in the Puerto Rico collections studied by the writer. *B. filicina* has a wide distribution in tropical America. Among other West Indian islands it has been collected on Jamaica, the type locality, *Swartz*, *Underwood*, and on Guadeloupe, *Husnot*. From the mainland the following stations may be quoted: Mexico, *Miquel*, *Leibold*, *Liebmann*; Costa Rica, *Maxon*; Colombia, *Moritz*, *Lindig*, *Karsten*; Brazil, *G. A. Lindberg*. The species has also been reported from Tahiti by Reichardt, the specimens having been collected by the Novara Expedition. Stephani confirms Reichardt's determination but suspects a mistake in the label. In all probability, therefore, *B. filicina* is confined to America.

It is evident that the present species was understood by the older writers and probably by Swartz himself in a much broader sense than is indicated above. *Jungermannia filicina* was originally described from sterile specimens, and it is by no means certain that these would be considered sufficient at the present time for a positive determination. In Stephani's opinion the Swartzian

specimen in the Lindenberg herbarium is an indeterminable fragment.\* Mitten, however, according to Spruce,† considered another Swartzian plant as identical with *B. tenuicaulis*. Whether these specimens actually represented portions of the type material is not apparent. The Lindenberg herbarium also contains several specimens of *J. filicina* which were communicated by Hooker, but Stephani refers them all to *B. fruticulosa* Tayl. In the herbarium at Berlin there is a Brazilian specimen collected by Raddi; Schiffner has recently determined this as *B. tenuicaulis*.‡ Until 1863 no attention was paid to the nature of the inflorescence as a specific character. In that year Gottsche§ referred to *B. filicina* a series of Mexican specimens in which the inflorescence was monoicous. In 1864 || he ascribed a monoicous inflorescence to the species as a definite character. Spruce also restricted the name *B. filicina* to monoicous plants and imagined that he saw traces of androecia in Hooker's figure of a fruiting plant. Both Stephani and Schiffner follow Spruce in thus restricting the name and the same course is pursued in the present paper.

As thus defined *B. filicina* is the only member of the genus in which the inflorescence is monoicous. Its closest ally is *B. fruticulosa*, which has a very similar geographical distribution. In this species, however, the inflorescence is always dioicous, and the plants are usually smaller and more closely pinnate than in *B. filicina*. Unfortunately these last two differences are inconstant, and specimens of *B. fruticulosa* are sometimes met with which are as large and as loosely pinnate as typical *B. filicina*. As Schiffner justly remarks, there are no absolutely trustworthy characters to separate the species except the differences in the inflorescence, and the attempt to keep them apart on this ground alone is perhaps questionable. The only other West Indian species with which *B. filicina* is likely to be confused is *B. tenuicaulis*. In this plant the secondary stems are even longer and tend to be more loosely pinnate, with widely spreading branches, some of which assume a flagelliform character. So far as observed the lobules in this species usually show a distinct apex, and this peculiarity may also

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\* Hedwigia 29: 2. 1890.

† Hep. Amaz. et And. 114. 1884.

‡ Hedwigia 33: 174. 1894.

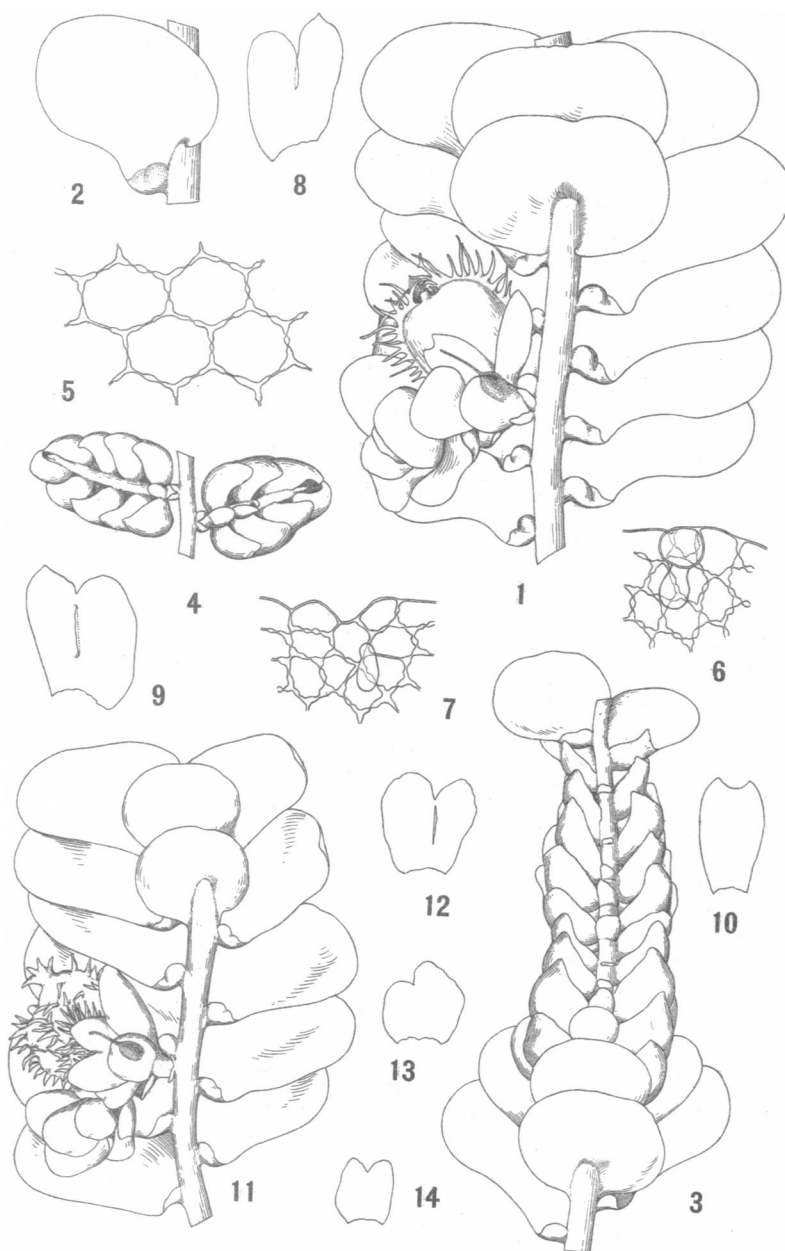
§ Mex. Leverm. 167. 1863.

|| Ann. Sci. Nat. Bot. V. 1: 45. 1864.

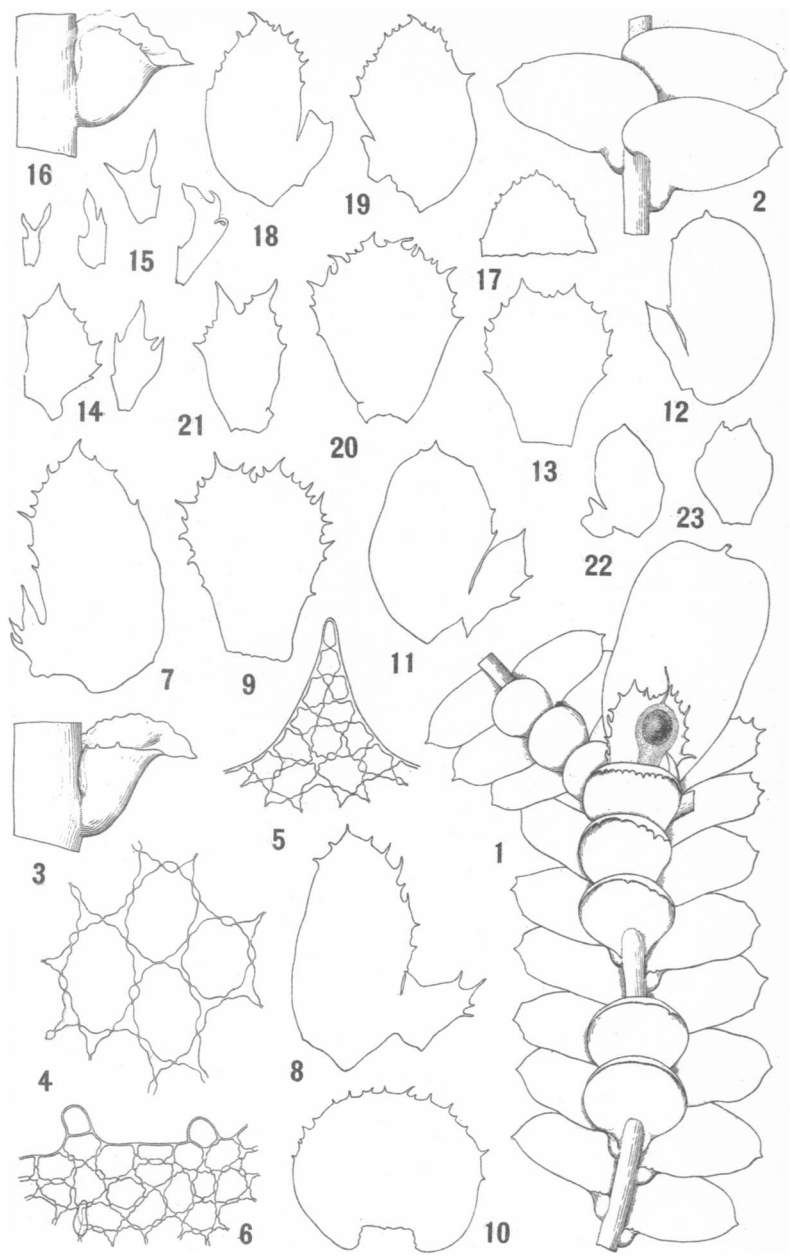
be cautiously employed in distinguishing it from *B. flicina*. According to Schiffner *B. trinitensis* Lehm. & Lindenb., of the Synopsis Hepaticarum, together with its variety *intermedia*, is synonymous with *B. tenuicaulis*, so far as the American specimens quoted are concerned. *B. trinitensis* was based on *Jungermannia trinitensis* Lehm. & Lindenb., which was published in 1833. It would appear, therefore, that the name *B. tenuicaulis* ought to be superseded, because it was not published until 1845. Unfortunately the type specimen of *J. trinitensis*, which was collected on the island of Trinidad by Beyrich, is too poorly developed and fragmentary to give an adequate idea of a specific type in this variable genus, and it becomes necessary to allow this name to disappear from the literature.

The genera most closely allied to *Bryopteris* are perhaps *Thysananthus* and *Ptychanthus*, both of which develop secondary stems from a prostrate caudex and usually exhibit a definite pinnate branching. In these two genera, however, subfloral innovations are always developed. *Thysananthus* is further distinguished by the dentate wings which are borne on the keels of the perianth, while in *Ptychanthus* the perianth, although smooth, bears from four to seven ridges in addition to the three normal keels. The remarkable leaf-cells in *Bryopteris* are hardly paralleled among the other *Jubuleae*. In *Caudalejeunea Lehmanniana*, to be sure, there are occasionally two or even three intermediate thickenings between two trigones (PLATES 33, FIGURE 7), but this seems to be a somewhat anomalous condition, and the cells are never strongly elongated. In spite of its undoubted affinity with the *Lejcuneeae*, *Bryopteris* also has much in common with the *Frullanieae* and especially with the genus *Jubula*. It agrees with this genus in its lack of pigmentation, in the morphology of its vegetative branches, in its pointed leaves and bracts, and in its trigonous perianth with smooth keels. Of course it differs in the structure of its lobules, in its leaf-cells, in its undivided underleaves, and in the absence of subfloral innovations, the last being a character which it shares with *Frullania*.

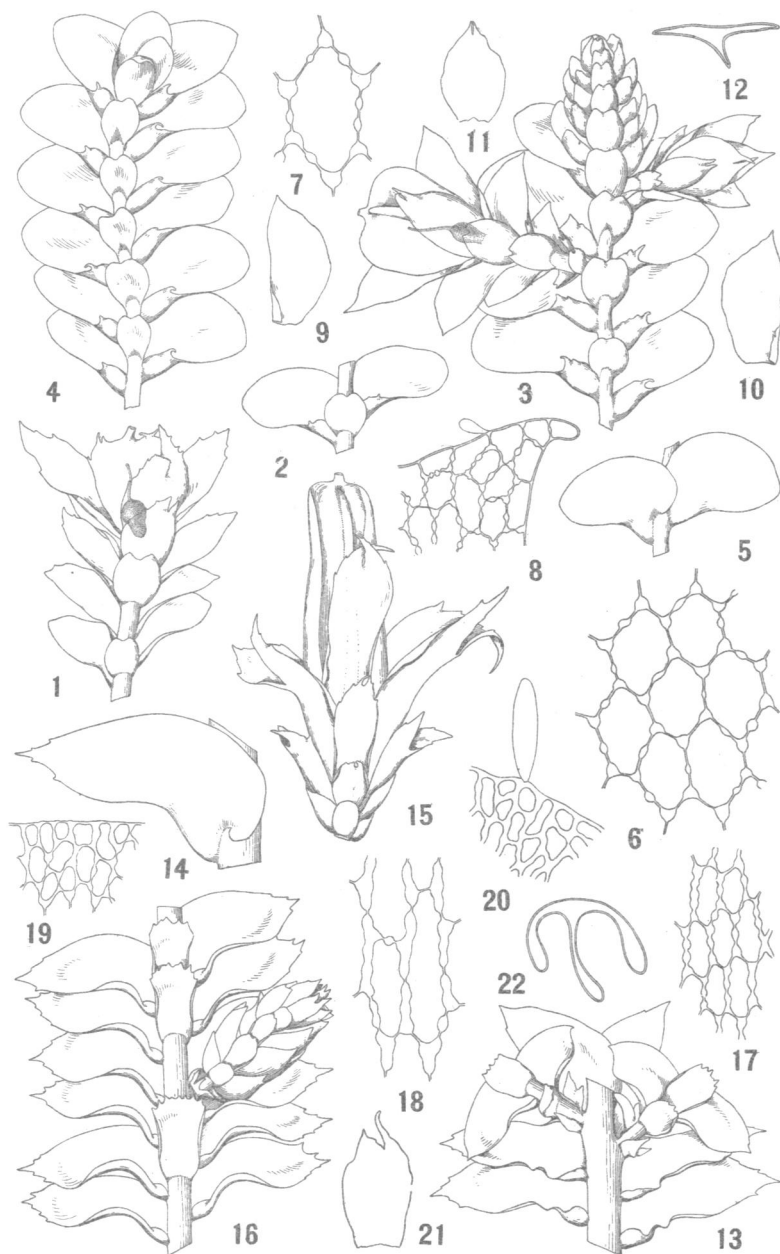
In the preparation of the present paper the writer is especially indebted to Herr F. Stephani, of Leipzig, Dr. von Keissler, of



1-10 SYMBIEZIDIUM TRANSVERSALE (Swartz) Trevis.  
11-14 SYMBIEZIDIUM BARBIFLORUM (Lindenb. & Gottsche) Evans.



MARCHESINIA BRACHIATA (Swartz) Schiffn.



1-12 CAUDALEJEUNEA LEHMANNIANA (Gottsche) Evans.

13-22 BRYOPTERIS FILICINA (Swartz) Nees.

Vienna, and Mr. M. B. Slater, of Malton, Yorkshire, for the loan of type specimens and authentic material. Valuable collections for study have also been supplied by the New York Botanical Garden.

YALE UNIVERSITY.

### Explanation of plates 31-33

As in the previous papers of this series the figures were drawn by the writer and prepared for publication by Miss Hyatt.

#### PLATE 31

*Symbiezidium transversale* (Swartz) Trevis. 1. Part of stem with female branch and perianth, postical view,  $\times 15$ . 2. Leaf, antical view,  $\times 15$ . 3. Proliferating male inflorescence borne on a leading branch, postical view,  $\times 15$ . 4. Two short male inflorescences with limited growth, postical view,  $\times 15$ . 5. Cells from middle of lobe,  $\times 265$ . 6, 7. Apices of lobules, showing hyaline papillae,  $\times 200$ . 8-10. Bracts and bracteole from one involucre,  $\times 25$ . The figures were all drawn from specimens collected by the writer (67).

*Symbiezidium barbiflorum* (Lindenb. & Gottsche) Evans. 11. Part of stem with female branch and perianth, postical view,  $\times 25$ . 12-14. Bracts and bracteole from one involucre,  $\times 25$ . The figures were all drawn from specimens collected by A. A. Heller (779).

#### PLATE 32

*Marchesinia brachiata* (Swartz) Schiffn. 1. Stem with perianth and two innovations, one of which has been cut off close to the base, postical view,  $\times 9$ . 2. Part of stem, antical view,  $\times 9$ . 3. Lobule, postical view,  $\times 35$ . 4. Cells from middle of lobe,  $\times 265$ . 5. Cells from apex of lobe,  $\times 200$ . 6. Apex of lobule,  $\times 200$ . 7-9. Bracts and bracteole from one involucre,  $\times 15$ . 10. Subfloral underleaf below same involucre,  $\times 15$ . 11-13. Bracts and bracteole from an involucre of a second specimen,  $\times 15$ . 14. Bracteal lobules from an involucre of a third specimen taken from a primary inflorescence,  $\times 15$ . 15. Bracteal lobules from the two secondary inflorescences borne on the subfloral innovations of the preceding primary inflorescence,  $\times 15$ . 16. Foliar lobule of a fourth specimen, postical view,  $\times 35$ . 17. Apex of lobe,  $\times 15$ . 18-20. Bracts and bracteole from one involucre,  $\times 15$ . 21. Bracteole from a fifth specimen,  $\times 15$ . 22, 23. Bract and bracteole from a sixth specimen,  $\times 15$ . Figs. 1-15 were drawn from specimens collected on John Crow Peak, Jamaica, by L. M. Underwood (727, 851) and by the writer (105); Figs. 16-18, from Puerto Rico specimens collected by the writer (59) and by Heller (1145); Figs. 22 and 23, from the specimens distributed in *Hepaticae Cubenses* as *Phragmicoma Bongardiana*.

#### PLATE 33

*Caudalejeunea Lehmanniana* (Gottsche) Evans. 1. Branch with perianth, postical view,  $\times 15$ . 2. Two leaves, postical view,  $\times 15$ . 3. Part of plant showing a perianth, a female inflorescence, and a male spike, postical view,  $\times 15$ . 4. Prostrate branch, postical view,  $\times 15$ . 5. Two leaves, antical view,  $\times 15$ . 6. Cells from middle of lobe,  $\times 265$ . 7. Cell from base of lobe,  $\times 265$ . 8. Apex of lobule,  $\times 200$ . 9-11. Bracts and bracteole from one involucre,  $\times 15$ . 12. Transverse section of perianth,

× 25. Figs. 1 and 2 were drawn from a portion of the original material preserved in the Lindenberg Herbarium at Vienna ; the remaining figures were drawn from A. A. Heller's Puerto Rico specimens (838).

*Bryopteris filicina* (Swartz) Nees. 13. Part of stem with bases of two branches, postical view, × 15. 14. Leaf, antical view, × 15. 15. Female branch (entire length) with perianth, postical view, × 25. 16. Part of a branch bearing a male inflorescence, postical view, × 15. 17. Cells from middle of lobe, × 265. 18. Cells from base of lobe, × 265. 19. Cells from antical margin of lobe, × 265. 20. Margin of lobule with hyaline papilla, × 265. 21. Leaf immediately behind involucre, × 25. 22. Transverse section of perianth, × 25. The figures were all drawn from specimens collected at Old England, Jamaica, by L. M. Underwood (XX)